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BRIEF ON APPEAL

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This brief contains these items under the following headings, and in the order set forth below (37 C.F.R. § 41.37(c)(1)):

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I. REAL PARTY IN INTEREST (37 C.F.R. § 41.37(c)(1)(i))

Assignments from each of the inventors to the sole assignee, Saint-Gobain Performance Plastics Corporation, of 150 Dey Road, Wayne, NJ 07470, were recorded by the USPTO on June 16, 2004, at Reel/Frame: 014738/0484. The real party of interest is Saint-Gobain Performance Plastics Corporation.

II. RELATED APPEALS AND INTERFERENCES (37 C.F.R. § 41.37(c)(1)(ii))

Appellants, Appellants' legal representatives, and Assignee know of no related appeals or interferences which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS (37 C.F.R. § 41.37(c)(1)(iii))

Claims 1-13, 16-31, 33-36, 38-42, and 51-53 remain pending herein. Claims 14, 15, 32, 37, and 43-50 were canceled in the Amendment filed June 15, 2005. Each of claims 1-13, 16-31, 33-36, 38-42, and 51-53 is hereby appealed by Appellants.

IV. STATUS OF AMENDMENTS (37 C.F.R. § 41.37(c)(1)(iv))

The claims hereby appealed by Appellants are based on the Amendment filed May 30, 2006. No amendment was offered or entered after the Final Office Action dated August 10, 2006.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER (37 C.F.R. § 41.37(c)(1)(v))

A concise explanation of the subject matter defined in each of the independent claims involved in the appeal is provided below.

A. Claim 1

Claim 1 is reproduced below for clarity.

> 1. A thermal interface material comprising:
>
> a polymer component;

> a phase change component mixed with the polymer component;
> and
> greater than about 7% by weight of a non-ionic surfactant mixed with the polymer component and the phase change component.

As described in the specification, the thermal interface material includes a polymer component, a phase change component, and a surfactant (pg. 6, paragraph [0025]). The thermal interface material may comprise greater than about 7% surfactant by weight (pg. 7, paragraph [0026]). In exemplary applications, the surfactant is preferably non-ionic (pg. 8, paragraph [0028]). A non-ionic surfactant may be derived from alkanolamide or glycerin. In one exemplary embodiment, the surfactant is a Ninol surfactant by Stepan Co. such as Ninol 1301, a modified fatty alkanolamide, Ninol M10, a cocamide MIPA, or PEG-6 cocamide surfactant and other cocamide based surfactants (pg. 8, paragraph [0028]). In another exemplary embodiment, the surfactant is an ester derived from reaction between glycerin and stearic acid, such as glyceryl stearate based surfactants, such as Stepan GMS pure (pg. 8, paragraph [0028]).

B. Claim 25

Claim 25 is reproduced below for clarity.

> 25. A thermal interface material comprising a phase change wax and greater than about 7% by weight of a non-ionic surfactant.

Claim 25 is similarly directed to a thermal interface material. The thermal interface material includes a phase change wax (pg. 6, paragraph [0025] and pg. 7, paragraph [0027]) and greater than about 7% by weight of a non-ionic surfactant (pg. 7, paragraph [0026] and pg. 8, paragraph [0028]).

C. Claim 36

Claim 36 is reproduced below for clarity.

> 36. A thermal interface tape comprising:
> a first layer comprising a conductive film; and

> a second layer comprising a thermal interface material comprising
> a phase change component and greater than about 7% by
> weight of a non-ionic surfactant.

Claim 36 is directed to a thermal interface tape (pg. 5, paragraph [0022] and FIG. 2) including a first layer comprising conductive film (pg. 6, paragraph [0023]) and a second layer comprising a thermal interface material. The thermal interface material comprises a phase change component (pg. 6, paragraph [0025] and pg. 7, paragraph [0027]) and greater than about 7% by weight of a non-ionic surfactant (pg. 7, paragraph [0026] and pg. 8, paragraph [0028]).

D. Claim 42

Claim 42 is reproduced below for clarity.

> 42. A microelectronic structure comprising:
> an integrated circuit active device;
> a heat sink; and
> a thermal interface tape comprising greater than about 7% by
> weight of a non-ionic surfactant and comprising a phase change
> component, the thermal interface tape disposed between and
> coupling the integrated circuit active device and the heat sink to
> each other.

Claim 42 is directed to a microelectronic structure including an integrated circuit active device, a heat sink, and a thermal interface tape (pg. 4, paragraph [0018] and FIG. 1). The thermal interface tape includes greater than about 7% by weight of a non-ionic surfactant and includes a phase change component (pp. 6-8, paragraphs [0025] – [0028]). The thermal interface tape is disposed between and couples the integrating circuit active device and the heat sink to each other (pg. 4, paragraph [0018] and FIG. 1).

E. Claim 51

Claim 51 is reproduced below for clarity.

> 51. A thermal interface material comprising a phase change component, greater than about 7% by weight of a non-ionic surfactant, and a thermally conductive filler, wherein the thermal impedance of the thermal interface material is ≤ 0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

Claim 51 is directed to a thermal interface including greater than about 7% by weight of a non-ionic surfactant (pg. 7, paragraph [0026] and pg. 8, paragraph [0028]), a phase change component (pg. 7, paragraph [0027]), and thermally conductive filler (pg. 8, paragraph [0029] and pg. 9, paragraph [0030]).

As further recited in claim 51, the thermal impedance of the thermal interface material is ≤0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material but containing no surfactant (pg. 9, paragraph [0032], pg. 15, paragraph [0058], and Table 7). As is clearly illustrated in the example of Table 7, thermal interface materials including particular non-ionic surfactants exhibit a reduction in thermal impedance relative to thermal interface materials that do not include at least about 7% by weight non-ionic surfactant.

F. Claim 52

Claim 52 is reproduced below for clarity.

> 52. A thermal interface tape comprising:
> a first layer comprising a conductive film; and
> a second layer comprising a thermal interface material coupled to the first layer, the second layer comprising greater than about 7% by weight of a non-ionic surfactant, a phase change component, a polymer, and thermally conductive filler, the thermal interface material having a wetting angle of not more

> than about 80 degrees and a thermal impedance of no more than about 0.115 °C in^2/W, at an operating temperature, wherein the thermal impedance of the thermal interface material is ≤ 0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

Claim 52 is directed to a thermal interface tape (pg. 4, paragraph [0022] and FIG. 2) including a first layer comprising a conductive film (pg. 6, paragraph [0023]) and a second layer comprising a thermal interface material coupled to the first layer. The second layer includes greater than about 7% by weight of a non-ionic surfactant (pg. 7, paragraph [0026] and pg. 8, paragraph [0028]), a phase change component (pg. 7, paragraph [0027]), a polymer (pg. 6, paragraph [0025]), and thermally conductive filler (pg. 8, paragraph [0029] and pg. 9, paragraph [0030]).

As recited in claim 52, the thermal interface material has a wetting angle of not more than about 80 degrees and a thermal impedance of not more than about 0.115 °C in^2/W, at an operating temperature (pg. 9, paragraph [0031] and pp. 14-15, paragraphs [0056]- [0058] and Tables 6 and 7). By way of example only, Table 6 clearly illustrates that thermal interface materials having greater than 7% by weight, and in particular, having between 14% and 25% by weight surfactant, provide a wetting angle of not greater than about 80 degrees, while thermal interface materials lacking surfactant do not have a desirable wetting angle. In an additional example, Table 7 clearly illustrates that particular thermal interface materials including greater than about 7% by weight surfactant have a thermal impedance of not more than about 0.115 °C in^2/W.

As further recited in claim 52, the thermal impedance of the thermal interface material is ≤0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant (pg. 9, paragraph [0032], pg. 15, paragraph [0058], and Table 7). As is clearly illustrated in the example of Table 7, thermal interface materials including particular non-ionic surfactants exhibit a reduction in thermal impedance relative to thermal interface materials that do not include at least about 7% by weight non-ionic surfactant.

G. Claim 53

Claim 53 is reproduced below for clarity.

> 53. A thermal interface material comprising a phase change wax and greater than about 7% by weight of a surfactant.

Claim 53 is directed to a thermal interface material (pg. 6, paragraph [0025]) including a phase change wax (pg. 7, paragraph [0027]) and greater than about 7% by weight of a surfactant (pg. 7, paragraph [0026] and pg. 8, paragraph [0028]).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL (37 C.F.R. § 41.37(c)(1)(vi))

A. Appellants respectfully request review of the rejection of claims 1-13, 16, 17, 21, 23-31, 33-36, 38, 40-42, and 51-53 under 35 U.S.C. § 103(a) over Duvall et al. (US 6,391,442, hereinafter "Duvall") in view of Yamazaki et al. (WO 03/004580, hereinafter "Yamazaki").

B. Appellants respectfully request review of the rejection of claims 1-13, 16-31, 33-36, 38-42, and 51-53 under 35 U.S.C. § 103(a) over Duvall in view of Hill et al. (EP 0 794 227 A2, hereinafter "Hill").

C. Appellants respectfully request review of the rejection of claims 1, 2, 6, 7, 10-13, 16-23, 25, 27, 28, 30, 31, 33-36, 38-42, and 51-53 under 35 U.S.C. § 103(a) over Bunyan et al. (US 6,054,198, hereinafter "Bunyan") in view of Hill.

VII. ARGUMENTS (37 C.F.R. § 41.37(c)(1)(vii))

A. Claims 1-13, 16, 17, 21, 23-31, 33-36, 38, 40-42, and 51-53 would not have been obvious under 35 U.S.C. § 103(a) over Duvall in view of Yamazaki.

1. Claims 1-13, 21, 23-31, 36, and 40-42 are patentable over Duvall in view of Yamazaki.

It is a bedrock principle under US Patent Law that the PTO has the burden of establishing a *prima facie* case of obviousness, which has three basic criteria: There must be some suggestion or motivation to modify the references or combined teachings thereof, there must be a reasonable expectation of success, and the prior art references must teach each and every claim limitation. See generally MPEP §§ 2142 and 2143. In particular, to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). In this regard, the PTO has failed has failed to establish *prima facie* obviousness.

Each of the independent claims 1, 25, and 36 is directed to a thermal interface material or tape that includes a phase change component or wax and greater than about 7% by weight of a non-ionic surfactant. The thermal interface material of claim 1 also includes a polymer component.

In its rejection, the PTO appears to primarily rely on Duvall. Duvall discloses a thermal interface material that includes thermally conductive filler particles and a phase change material. The phase change material includes a polymer component and a melting point component (relied on as the claimed phase change component or wax), which adjusts the softening temperature of the phase change material. See Duvall, Abstract.

Duvall teaches that the phase change substance is a mixture of two or more compatible components or materials that undergoes a reversible solid-liquid phase change at the operating temperature of the device, and that the first component of the phase change substance is a polymer component which includes a polymer. See Duvall, col. 5, ll. 46-50. Duvall teaches polymers such as silicone, acrylic, natural rubber, synthetic rubber, or other appropriate elastomeric materials. See Duvall, col. 5, l. 66- col. 6, l. 4. The PTO relies on the disclosure of such a polymer to meet the polymer component of claim 1.

The second component of the phase change substance is a melting point component. Examples of suitable melting point components include C_{12}-C_{16} alcohols, acids, esters, and waxes, low molecular weight styrenes, methyl triphenyl silane materials, combinations thereof, and the like. Suitable C_{12}-C_{12}-C_{16} acids and alcohols include myristyl alcohol, cetyl alcohol, stearyl alcohol, myristyl acid, and stearic acid. Preferred waxes include microcrystalline wax, paraffin waxes, and other wax-like compounds, such as cyclopentane, heceicosyl; 2-heptadecanone; pentacosaneyl; silicic acid, tetraphenyl ester; octadecanoic acid; 2-[2-[2-(2hydroxyethoxy) ethoxy] ethoxy] ethyl ester; cyclohexane, docosyl; polystyrene; polyamide resins; disiloxane 1,1,1, trimethyl-3,3; and triphenyl silane. See Duvall, col. 6, ll. 11-27. The PTO relies on the second component to meet the phase change component of claims 1 and 36 and the phase change wax of claim 25.

Duvall is silent regarding use of non-ionic surfactants. The PTO correctly acknowledges that Duvall does not teach use of greater than 7wt% of a nonionic surfactant. As such, the PTO appears to turn to Yamazaki, proposing the partial replacement of the phase change substance of Duvall to form a blend including a component from Yamazaki. However, Yamazaki fails to teach or suggest blends specifically including non-ionic surfactant, and further, fails to teach or suggest blends of components in specific amounts, one being a non-ionic surfactant in an amount greater than about 7% by weight.

In fact, Yamazaki teaches a thermally conductive composition including "(a) 100 parts by weight of a wax, (b) 10 to 1,000 parts by weight of a compound ... (c) 10 to 2,000 parts by weight of a thermoconductive filler and (d) 0 to 1,000 parts by weight of a softener." See Yamazaki, pg. 2, l. 25- pg. 3 l. 3. According to Yamazaki, there "are no particular restrictions on the wax, and natural wax, synthetic wax, blended wax, or the like can all be used... Examples of synthetic waxes include ...fatty acids, acid amides, esters, ketones, and others such as 12-hydroxystearic acid, stearic amide, anhydrous phthalic imide, and chlorinated hydrocarbons." See Yamazaki, pg. 3 l. 26 – pg. 4, l. 2.

In the Final Office Action dated August 10, 2006, the PTO appears to rely on Yamazaki's disclosure that a synthetic wax may include stearic amide to overcome the deficiencies of Duvall, stating that it would have obvious to utilize a fatty acid amide in a blend with the wax taught in Duvall. That is, the PTO has argued that it would have been obvious to partially replace the wax of Duvall with a fatty acid amide. The PTO further asserts that the motivation for the combination would have been that said fatty acid amide is functionally equivalent to the wax taught by Duvall.

Foremost, the PTO has provided no such technical reasoning or literature to suggest that the substitution of Duvall's melting point component with Yamazaki's stearic amide. Even assuming the "functional equivalency" of the two components, such logic would lead to complete substitution of one component for another, which is outside the scope of the claimed invention, which requires presence of both components.

In this respect, Appellants have discovered that the combination of nonionic surfactant and a phase change component in the context of thermal interface materials provides notable technical advantages, such technical advantages being indicative of non-obviousness. Specifically, Appellants discovered that the combination of the claimed nonionic surfactant and a phase change component provides both improved peel strength and reduced thermal impedance. In particular, Appellants have discovered the combination leads to significant increases in peel strength, as illustrated in examples 1-4 relative to example 5 of the present specification, which is advantageous in thermal interface tape embodiments. Furthermore, comparative testing illustrated in example 6 of the present specification shows that embodiments of the claimed invention provide notably reduced thermal impedance.

Moreover, the cited references fail to suggest the combination of a phase change component and greater than 7% by weight non-ionic surfactant. Seven percent (7%) represents the point at which notable, commercially viable improvements in peel strength and thermal performance have been observed by the Appellants. The claimed greater than 7% surfactant is not even remotely suggested in the cited references.

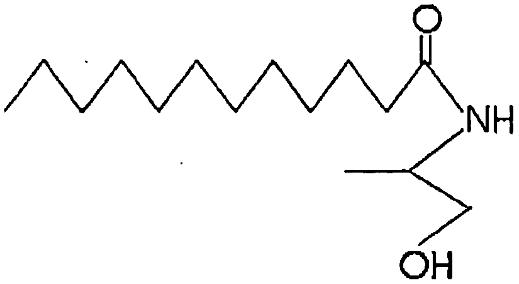
For at least the foregoing reasons, Appellants respectfully submit that claims 1-13, 21, 23-31, 36, and 40-42 recite patentable subject matter. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

2. Claims 16, 33, and 38 are patentable over Duvall in view of Yamazaki.

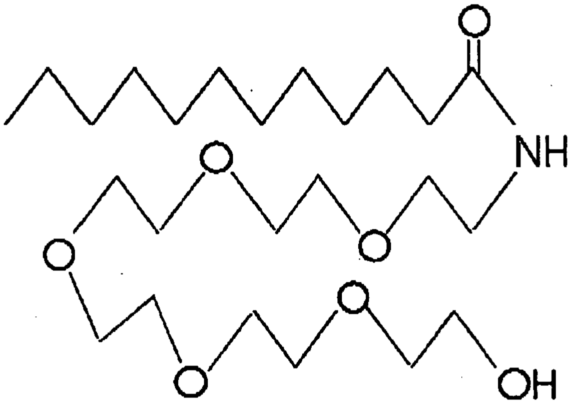
In addition to the reasons stated above with respect to claims 1, 25, and 36, claims 16, 33, and 38 include further patentable subject matter not found in Duvall or Yamazaki. In particular, claims 16, 33, and 38 recite that the non-ionic surfactant is derived from alkanolamide.

In the Final Office Action, the PTO erroneously relies on stearic amide for the claimed alkanolamide. Stearic amide is not an alkanolamide and has clear structural and functional differences from alkanolamide. As such, the references fail to teach or remotely suggest that the non-ionic surfactant is derived from alkanolamide.

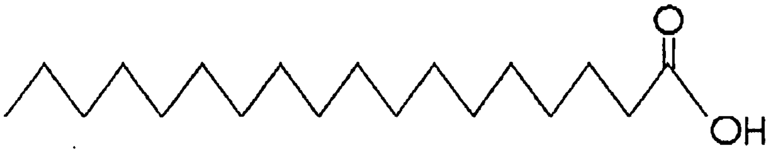
More particularly, alkanolamide, as implied by its name, is characterized by a substitution of one or more hydrogens of an amide group with groups that include alcohol functionality. Particular alkanolamides show promise as non-ionic surfactants. For example, alkanolamides derived from cocamide exhibit properties desirable in a non-ionic surfactant. See the present specification, pg. 8, paragraph [0028] and Tables 3 and 4. Cocamide is a fatty amide derived from coconut oil and is predominantly characterized by a chain length of 12 to 16 carbons terminating in an amide group. The alkanolamide cocamide mono-isopropyl alcohol (MIPA) (commercially available as Ninol M10 by Stepan Co.) is characterized by substitution of a hydrogen in the amide group of cocamide with an isopropyl alcohol group. As such, cocamide MIPA takes the general form:



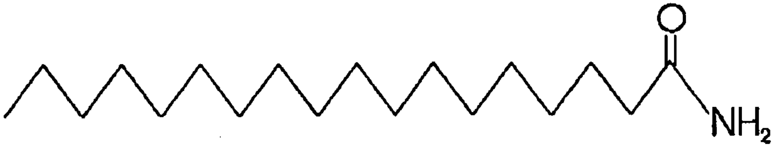
Similarly, PEG-6 cocamide, also available from Stepan Co., is characterized by polyethylene glycol (PEG) having an average chain length of 6 ethylene glycol monomers substituted for a hydrogen on the amide group of the cocamide, as implied in its name. PEG-6 cocamide takes the general form:



In contrast, fatty acids are characterized by a chain of carbons that terminate in carboxylic acid groups. For example, stearic acid has an 18 carbon chain terminating in a carboxylic acid group. Stearic amide is characterized by a chain of 18 carbons that terminates in an amide group. For example, stearic acid takes the form:



and stearic amide takes the form:



Clearly alkanolamides are not fatty acids, and in particular, are not stearic amides.

For at least the foregoing reasons, Appellants respectfully submit that claims 16, 33, and 38 recite patentable subject matter in addition to the patentable subject matter of claims 1, 25, and 36, respectively. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

3. Claim 17 is patentable over Duvall in view of Yamazaki.

In addition to the reasons stated above with respect to claim 1, claim 17 includes further patentable subject matter not found in Duvall or Yamazaki. In particular, claim 17 recites that the non-ionic surfactant is derived from cocamide.

In the Final Office Action, the PTO appears to assert that Yamazaki's disclosure of stearic amide can be generalized to include a teaching of non-ionic surfactant derived from cocamide. Stearic amide includes an 18 carbon chain terminating in an amide group. In contrast, cocamide predominantly includes a 12 to 16 carbon chain terminating in an amide group. Further, as illustrated in above, examples of a non-ionic surfactant derived from cocamide include alkanolamide derived from cocamide. Stearic amide is not cocamide and is not a non-ionic surfactant derived from cocamide.

For at least the foregoing reasons, Appellants respectfully submit that claim 17 recites patentable subject matter in addition to the patentable subject matter of claim 1. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

4. Claim 34 is patentable over Duvall in view of Yamazaki.

In addition to the reasons stated above with respect to claim 25, claim 34 includes further patentable subject matter not found in Duvall or Yamazaki. In particular, claim 34 recites that the non-ionic surfactant is derived from glycerin.

In the Final Office Action, the PTO appears to rely on Yamazaki's disclosure of stearic amide to teach all non-ionic surfactants, including the claimed non-ionic surfactant derived from glycerin. Stearic amide is not derived from glycerin and is not a non-ionic surfactant derived from glycerin.

For at least the foregoing reasons, Appellants respectfully submit that claim 34 recites patentable subject matter in addition to the patentable subject matter of claim 25. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

5. Claim 35 is patentable over Duvall in view of Yamazaki.

In addition to the reasons stated above with respect to claim 25, claim 35 includes further patentable subject matter not found in Duvall or Yamazaki. In particular, claim 35 recites that the thermal interface material comprises greater than about 10% by weight of the surfactant.

As stated above, the references do not teach or suggest a partial substitution of the wax of Duvall with the stearic amide of Yamazaki, let alone a partial substitution to contain greater than 7% by weight of stearic amide. Further, the references do not suggest use of greater than about 10% of a stearic amide, let alone, greater than about 10% by weight of a surfactant.

For at least the foregoing reasons, Appellants respectfully submit that claim 35 recites patentable subject matter in addition to the patentable subject matter of claim 25. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

6. Claim 51 is patentable over Duvall in view of Yamazaki.

In addition to the reasons stated above, claim 51 includes further patentable subject matter not found in Duvall or Yamazaki. In particular, claim 51 also recites that the thermal impedance of the thermal interface material is ≤ 0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

Even ignoring Duvall's and Yamazaki's failure to teach or even remotely suggest use of greater than about 7% non-ionic surfactant, Duvall and Yamazaki fail to teach or even remotely suggest the claimed improvement in thermal impedance. In an attempt to address such failures, the Examiner appears to take the position that the claimed thermal impedance is inherent to a composition including surfactant, asserting that the surfactant insures homogeneous dispersion of the conductive particles.

However, to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson* 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). The claimed thermal impedance does not necessarily result from the proposed combination. Therefore, the claimed thermal impedance is not inherent to the proposed combination.

For at least the foregoing reasons, Appellants respectfully submit that claim 51 recites patentable subject matter in addition to the patentable subject matter discussed above in relation to claims 1, 25, 36, and 42. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

7. Claim 52 is patentable over Duvall in view of Yamazaki.

In addition to the reasons stated above, claim 52 includes further patentable subject matter not found in Duvall or Yamazaki. In particular, claim 52 also recites that the thermal interface material has a wetting angle of not more than about 80 degrees and a thermal impedance of no more than about 0.115 $^{\circ}C\ in^2/W$, at an operating temperature.

Claim 52 further recites that the thermal impedance of the thermal interface material is ≤ 0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

Even ignoring Duvall's and Yamazaki's failure to teach or even remotely suggest use of greater than about 7% non-ionic surfactant, Duvall and Yamazaki fail to teach or suggest the claimed wetting angle or improvement in thermal impedance. In an attempt to address such failures, the Examiner appears to take the position that it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the amount of surfactant added to the thermal interface composition in order to optimize the composition's wetting angle. The PTO further asserts that the claimed thermal impedance is inherent to compositions with the claimed wetting angle.

However, to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson* 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). The claimed thermal impedance does not necessarily result from the proposed combination having the claimed wetting angle. Therefore, the claimed thermal impedance is not inherent to the proposed combination.

Further, no evidence is provided that one skilled in the art at the time of the invention would have been motivated to seek a desired wetting angle in the thermal interface material. In fact, Appellants discovered that thermal interface materials exhibiting the claimed wetting angle provide desirable technical advantages, such technical advantages being indicative of non-obviousness. By way of example only, example 6 of the present specification illustrates previously unrecognized advantages, such as a reduction in a differential temperature, resulting from a thermal interface material having a wetting angle of less than 80 degrees.

For at least the foregoing reasons, Appellants respectfully submit that claim 52 recites patentable subject matter in addition to the patentable subject matter discussed above in relation to claims 1, 25, 36, and 42. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

8. Claim 53 is patentable over Duvall in view of Yamazaki.

Claim 53 is directed to a thermal interface material comprising a phase change wax and greater than about 7% by weight of a surfactant. As stated above, the references do not suggest a partial substitution of the wax of Duvall with the synthetic wax of Yamazaki, let alone a partial substitution to contain greater than 7% by weight of stearic amide, or even partial substitution to contain greater than 7% by weight surfactant.

In this respect, Appellants have discovered that the combination of nonionic surfactant (greater than 7% by weight) and a phase change component in the context of thermal interface materials provides notable technical advantages as already discussed herein.

For at least the foregoing reasons, Appellants respectfully submit that claim 53 recites patentable subject matter. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

B. Appellants respectfully request review of the rejection of claims 1-13, 16-31, 33-36, 38-42, and 51-53 under 35 U.S.C. § 103(a) over Duvall in view of Hill.

1. Claims 1-13, 21-31, 36, and 40-42 are patentable over Duvall in view of Hill.

As described above, the PTO appears to rely on Duvall to meet the polymer component and the phase change component or wax. Duvall fails to teach or remotely suggest use of a surfactant. In particular, the PTO correctly acknowledges that Duvall does not teach that the composition should comprise greater than about 7 % by weight of a non-ionic surfactant. As such, the PTO turns to Hill, alleging that Hill teaches use of greater than 1% by weight of a non-ionic surfactant. In fact, Hill discloses use of 1%-4.5% non-ionic surfactant and teaches away from use of more than 4.5% by weight.

Hill is directed to a molding compound comprising a polymer base material, a filler, and a non-ionic surfactant. The filler comprises boron nitride in a concentration of at least about 60% by weight of the composition. The non-ionic surfactant is selected from the class consisting of carboxylic acid amides and carboxylic acid esters. See Hill, Abstract. Hill is silent regarding species of carboxylic acid amides.

Hill discloses polymer base materials such as a polyimide, epoxy, cyanate ester or polyester. See Hill, pg. 2, ll. 38-39. Boron nitride ("BN") powder, an epoxy cresol novolak ("ECN") master batch, and a phenyl novolak hardener ("PN") master batch are ball milled and hot roll milled, and subsequently molded. See Hill, pg. 2, l. 41- pg. 3, l. 13. Hill further discloses that "the addition of any surfactant becomes a detriment above a concentration of about 4.5% of the BN filler weight in that above this concentration the presence of the surfactant adversely affects the thermal conductivity of the composition causing it to drop." See Hill, pg. 3, ll. 19-21, emphasis added. In particular, a "Sorbitan Monostearate surfactant was added into this composition at increments of 1 to 5 percent by weight of the BN to determine its effect on spiral flow and thermal conductivity... it is apparent that the benefit of a nonionic surfactant is cumulative to that realized from using boron nitride filler within a narrow concentration range for the surfactant of between 1 to 4.5%." See Hill, pg. 3, ll. 22-35. As such, Hill only teaches use of a non-ionic surfactant in amounts between 1 to 4.5% by weight of the BN filler, such percents being lower when calculated based on the entire weight of the composition.

In each of the examples 1-3, Hill discloses using less than 5% by weight surfactant based on the weight of the BN filler and not greater than 70% by weight of the filler is used in the molding compound. As such, Hill fails to teach use of a nonionic surfactant in amounts greater than about 5% by weight (actually, Hill teaches a max of 3.5% by weight based on the total weight of the formulation).

As such, Hill fails to teach use of greater than 7% by weight non-ionic surfactant and in fact, teaches away from the claimed invention. A prior art reference must be considered in its entirety, i.e., as a whole including portions leading away from the claimed invention. *W. L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. Denied, 469 US 851 (1984). In fact, teaching way from the art is a per se demonstration of lack of *prima facie* obviousness. See, e.g., *In re Dow*

Chemical Co., 837 F.2d 469, 5 USPQ2d 1529 (Fed. Cir. 1988); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Nielson*, 816 F.2d 1567, 2 USPQ2d 1525 (Fed. Cir. 1987).

To one of ordinary skill in the art, Hill teaches use of not greater than 4.5% by weight of the filler and in fact, teaches a way from using amounts greater than 4.5 wt% based on the weight of the filler by advocating a "narrow concentration range" and expressly noting adverse effects if concentrations above 4.5% are used. As such, the combination of Duvall and Hill fails to teach or remotely suggest greater than about 7% by weight of a nonionic surfactant mixed with the polymer component and the phase change component.

In contrast, Appellants have discovered that the combination of nonionic surfactant (greater than 7% by weight) and a phase change component in the context of thermal interface materials provides notable technical advantages as already discussed herein.

For at least the foregoing reasons, Appellants respectfully submit that claims 1-13, 21-31, 36, and 40-42 recite patentable subject matter. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

2. Claims 16, 33, and 38 are patentable over Duvall in view of Hill.

In addition to the reasons stated above with respect to claim 1, 25, and 36, claims 16, 33, and 38 include further patentable subject matter not found in Duvall or Hill. In particular, claims 16, 33, and 38 recite that the non-ionic surfactant is derived from alkanolamide.

In the Final Office Action, the PTO erroneously appears to rely Hill's teaching of a carboxylic acid amide for the claimed alkanolamide. As noted above, carboxylic acid amide is not alkanolamide and has clear structural and functional differences from alkanolamide.

For at least the foregoing reasons, Appellants respectfully submit that claims 16, 33, and 38 recite patentable subject matter in addition to the patentable subject matter of claims 1, 25, and 36, respectively. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

3. Claim 17 is patentable over Duvall in view of Hill.

In addition to the reasons stated above with respect to claim 1, claim 17 includes further patentable subject matter not found in Duvall and Hill. In particular, claim 17 recites that the non-ionic surfactant is derived from cocamide.

In the Final Office Action, the PTO appears to assert that Hill's disclosure of carboxylic acid amide can be generalized to include a teaching of non-ionic surfactant derived from cocamide. Such a broad teaching without any suggestion of a species leads to a plethora of possible variations with no indication as to which variation is likely to succeed. At best, the teaching makes it obvious to try any one of a number of carboxylic acid amides. Nevertheless, as illustrated above, examples of a non-ionic surfactant derived from cocamide include alkanolamide derived from cocamide. Carboxylic acid amide is not alkanolamide, let alone an alkanolamide derived from cocoamide.

For at least the foregoing reasons, Appellants respectfully submit that claim 17 recites patentable subject matter in addition to the patentable subject matter of claim 1. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

4. Claims 18, 34, and 39 are patentable over Duvall in view of Hill.

In addition to the reasons stated above with respect to claims 1, 25, and 36, claims 18, 34, and 39 include further patentable subject matter not found in Duvall or Hill. In particular, claims 18, 34, and 39 recite that the non-ionic surfactant is derived from glycerin.

In the Final Office Action, the PTO appears to rely on Hill's disclosure of carboxylic acid esters for the claimed non-ionic surfactant derived from glycerin. Such a broad category of carboxylic acid esters also provides a plethora of possible variations without indication as to which variation is likely to succeed, at best, making it obvious to try any one of a number of carboxylic acid esters. More particularly, Hill nowhere discloses a non-ionic surfactant derived from glycerin.

In this respect, Appellants have discovered that the use of non-ionic surfactants derived from glycerin within the claimed composition provides unexpected technical advantages to thermal interface materials, such technical advantages being indicative of non-obviousness. In particular, the combination provides improved peel strength as can be noted by comparison of examples 1 and 4 of the present specification. As is illustrated, use of a non-ionic surfactant derived from glycerin as at least part of the non-ionic surfactant provides an increase in peel strength of approximately 4 g/in.

For at least the foregoing reasons, Appellants respectfully submit that claims 18, 34, and 39 recite patentable subject matter in addition to the patentable subject matter of claims 1, 25, and 36, respectively. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

5. Claims 19 and 35 are patentable over Duvall in view of Hill.

In addition to the reasons stated above with respect to claims 1 and 25, claims 19 and 35 include further patentable subject matter not found in Duvall and Hill. In particular, claims 19 and 35 recite that the thermal interface material comprises greater than about 10% by weight of the surfactant.

As stated above, Hill clearly teaches away from using greater than 4.5% non-ionic surfactant, stating that "the addition of any surfactant becomes a detriment above a concentration of about 4.5% of the BN filler weight." See Hill, pg. 3, ll. 19-20. As such, Hill clearly teaches away from the proposed combination, and in particular, teaches away from a combination in which the surfactant is used in amounts greater than about 10% by weight.

For at least the foregoing reasons, Appellants respectfully submit that claims 19 and 35 recite patentable subject matter in addition to the patentable subject matter of claims 1 and 25, respectively. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

6. Claim 20 is patentable over Duvall in view of Hill.

In addition to the reasons stated above with respect to claim 1, claim 20 includes further patentable subject matter not found in Duvall or Hill. In particular, claim 20 recites that the thermal interface material comprises between 14% and 25% by weight of the surfactant.

As stated above, Hill clearly teaches away from using greater than 4.5% non-ionic surfactant, stating that "the addition of any surfactant becomes a detriment above a concentration of about 4.5% of the BN filler weight." See Hill, pg. 3, ll. 19-20. As such, Hill clearly teaches away from the proposed combination, and in particular, teaches away from a combination in which the surfactant is used in amounts between about 14% and 25% by weight.

For at least the foregoing reasons, Appellants respectfully submit that claim 20 recites patentable subject matter in addition to the patentable subject matter of claim 1. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

7. Claim 51 is patentable over Duvall in view of Hill.

In addition to the reasons stated above, claim 51 includes further patentable subject matter not found in Duvall or Hill. In particular, claim 51 recites that the thermal impedance of the thermal interface material is ≤0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

In addition to Duvall's and Hill's failure to teach use of non-ionic surfactant in amounts greater than 7% by weight, Duvall and Hill fail to teach or suggest the claimed improvement in thermal impedance. In an attempt to address such failures, the Examiner appears to take the position that the claimed thermal impedance is inherent to a composition including surfactant, asserting that the surfactant insures homogeneous dispersion of the conductive particles.

However, to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson* 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). The claimed thermal impedance does not necessarily result from the proposed combination. Therefore, the claimed thermal impedance is not inherent to the proposed combination.

For at least the foregoing reasons, Appellants respectfully submit that claim 51 recites patentable subject matter in addition to the patentable subject matter discussed above in relation to claims 1, 25, 36, and 42. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

8. Claim 52 is patentable over Duvall in view of Hill.

In addition to the reasons stated above, claim 52 includes further patentable subject matter not found in Duvall or Hill. In particular, claim 52 recites that the thermal interface material has a wetting angle of not more than about 80 degrees and a thermal impedance of no more than about 0.115 $^{\circ}C\ in^2/W$, at an operating temperature. Claim 52 further recites that the thermal impedance of the thermal interface material is ≤ 0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

In addition to Duvall's and Hill's failure to teach use of non-ionic surfactant in amounts of greater than 7% by weight, Duvall and Hill fail to teach or even suggest the claimed wetting angle or improvement in thermal impedance. In an attempt to address such failures, the Examiner appears to take the position that it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the amount of surfactant added to the thermal interface composition in order to optimize the composition's wetting angle. The PTO further asserts that the claimed thermal impedances is inherent to compositions with the claimed wetting angle.

However, to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson* 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). The claimed thermal impedance does not necessarily result from the proposed combination having the claimed wetting angle. Therefore, the claimed thermal impedance is not inherent to the proposed combination.

Further, no evidence is provided that one skilled in the art at the time of the invention would have been motivated to seek a desired wetting angle in the thermal interface material. In fact, Appellants discovered that thermal interface materials exhibiting the claimed wetting angle provide desirable technical advantages, such technical advantages being indicative of non-obviousness. By way of example only, example 6 of the present specification illustrates previously unrecognized advantages, such as a reduction in a differential temperature, resulting from a thermal interface material having a wetting angle of less than 80 degrees.

For at least the foregoing reasons, Appellants respectfully submit that claim 52 recites patentable subject matter in addition to the patentable subject matter discussed above in relation to claims 1, 25, 36, and 42. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

9. Claim 53 is patentable over Duvall in view of Hill.

Claim 53 is directed to a thermal interface material comprising a phase change wax and greater than about 7% by weight of a surfactant. As stated above, Hill clearly teaches against using greater than 4.5% non-ionic surfactant, stating that "the addition of any surfactant becomes a detriment above a concentration of about 4.5% of the BN filler weight." See Hill, pg. 3, ll. 19-20. As such, Hill clearly teaches away from the proposed combination, and in particular, teaches away from a combination in which the surfactant is used in amounts greater than about 7% by weight.

In this respect, Appellants have discovered that the combination of nonionic surfactant (greater than 7%) and a phase change component in the context of thermal interface materials provides notable technical advantages as already discussed herein.

For at least the foregoing reasons, Appellants respectfully submit that claim 53 recites patentable subject matter. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

C. Appellants respectfully request review of the rejection of claims 1, 2, 6, 7, 10-13, 16-23, 25, 27, 28, 30, 31, 33-36, 38-42, and 51-53 under 35 U.S.C. § 103(a) over Bunyan in view of Hill.

1. Claims 1, 6, 7, 10-13, 21-23, 25, 27, 28, 30, 31, 36, and 40-42 are patentable over Bunyan in view of Hill.

Bunyan discloses a thermally conductive interface formed as a self supporting layer of a thermally conductive material, which has a transition temperature between two phases. See Bunyan, Abstract. In one preferred embodiment, the material is formulated as a "form-stable blend of: (a) from about 25 to 50% by weight of a pressure sensitive adhesive (PSA) component …; (b) from about 50 to about 75% by weight of an alpha-olefinic, thermoplastic component; and (c) from about 20 to 80% by weight of one or more thermally-conductive fillers." See Bunyan, col. 8, ll. 16-23.

The PSA component is of an acrylic-based, hot-melt variety, such as a homopolymer, copolymer, terpolymer, interpenetrating network, or blend of an acrylic or (meth)acrylic acid, an acrylate such as butyl acrylate, and/or an amide such as acrylamide. See Bunyan, col. 8, ll. 30-34. The α-olefinic thermoplastic component is a polyolefin which may be characterized as a 'low melt' composition. A representative material is an amorphous polymer of a C_{10} or higher alkene. See Bunyan, col. 8, ll. 42-48.

"In an alternative embodiment, a paraffinic wax or other natural or synthetic ester of a long-chain (C_{16} or greater) carboxylic acid and alcohol having a melting temperature of from about 60-70°C may be substituted for the thermoplastic and PSA components to comprise about 20-80% by weight of the formulation." See Bunyan, col. 9, ll. 9-14.

The PTO appears to rely on the thermoplastic polymer or the PSA component to meet the claimed polymer component of claim 1 and appears to rely on the paraffin wax to meet the claimed phase change wax of claim 25. Note, Bunyan teaches use of one or the other in a composition, not both.

Further, Bunyan fails to teach or suggest use of a non-ionic surfactant. Accordingly, the PTO appears to turn to Hill, alleging that Hill teaches use of greater than 1% by weight of a non-ionic surfactant. In fact, Hill discloses use of 1%-4.5% non-ionic surfactant and teaches away from use of more than 4.5% by weight.

As stated above, Hill fails to teach use of greater than 7% by weight non-ionic surfactant, and indeed teaches away from the claimed invention. A prior art reference must be considered in its entirety, i.e., as a whole including portions leading away from the claimed invention. *W. L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. Denied, 469 US 851 (1984). In fact, teaching way from the art is a per se demonstration of lack of *prima facie* obviousness. See, e.g., *In re Dow Chemical Co.*, 837 F.2d 469, 5 USPQ2d 1529 (Fed. Cir. 1988); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Nielson*, 816 F.2d 1567, 2 USPQ2d 1525 (Fed. Cir. 1987).

To one of ordinary skill in the art, Hill teaches use of not greater than 4.5% by weight of the filler and in fact, teaches a way from using amounts greater than 4.5 wt% based on the weight of the filler by advocating a "narrow concentration range" and expressly noting adverse effects if concentrations above 4.5% are used. As such, the combination of Bunyan and Hill fails to teach or remotely suggest greater than about 7% by weight of a nonionic surfactant mixed with the polymer component and the phase change component.

In this respect, Appellants have discovered that the combination of nonionic surfactant and a phase change component in the context of thermal interface materials provides notable technical advantages as already discussed above.

For at least the foregoing reasons, Appellants respectfully submit that claims 1, 6, 7, 10-13, 21-23, 25, 27, 28, 30, 31, 36, and 40-42 recite patentable subject matter. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

2. Claim 2 is patentable over Bunyan in view of Hill.

In addition to the reasons stated above with respect to claim 1, claim 2 includes further patentable subject matter not found in Bunyan or Hill. In particular, claim 2 recites that the phase change component comprises a phase change wax.

The PTO appears to rely on Bunyan for the phase change wax, stating in the Final Office Action that "olefinic low melt component may comprise a wax." See Final Office Action, pg. 7. In fact, Bunyan teaches use of a paraffinic wax only as a replacement for both the thermoplastic and the PSA component. As such, the proposed combination either lacks a phase change wax or lacks a polymer component.

For at least the foregoing reasons, claim 2 is patentable over Bunyan in view of Hill. As such, Appellants respectfully request reversal of this ground of rejection by the Board.

3. Claims 16, 33, and 38 are patentable over Bunyan in view of Hill.

In addition to the reasons stated above with respect to claims 1, 25, and 36, claims 16, 33, and 38 include further patentable subject matter not found in Bunyan or Hill. In particular, claims 16, 33, and 38 recite that the non-ionic surfactant is derived from alkanolamide.

In the Final Office Action, the PTO erroneously appears to rely Hill's teaching of a carboxylic acid amide for the claimed alkanolamide. As noted above, carboxylic acid amide is not an alkanolamide and has clear structural and functional differences from alkanolamide.

For at least the foregoing reasons, Appellants respectfully submit that claims 16, 33, and 38 recite patentable subject matter in addition to the patentable subject matter of claims 1, 25, and 36, respectively. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

4. Claim 17 is patentable over Bunyan in view of Hill.

In addition to the reasons stated above with respect to claim 1, claim 17 includes further patentable subject matter not found in Bunyan or Hill. In particular, claim 17 recites that the non-ionic surfactant is derived from cocamide.

In the Final Office Action, the PTO appears to assert that Hill's disclosure of carboxylic acid amide can be generalized to include a teaching of non-ionic surfactant derived from cocamide. Such a broad teaching without any suggestion of a species leads to a plethora of possible variations with no indication as to which variation is likely to succeed. At best, the teaching makes it obvious to try any one of a number of carboxylic acid amides. Nevertheless, as illustrated above, examples of a non-ionic surfactant derived from cocamide include alkanolamide derived from cocamide. Carboxylic acid amide is not alkanolamide, let alone an alkanolamide derived from cocoamide.

For at least the foregoing reasons, Appellants respectfully submit that claim 17 recites patentable subject matter in addition to the patentable subject matter of claim 1. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

5. Claims 18, 34, and 39 are patentable over Bunyan in view of Hill.

In addition to the reasons stated above with respect to claims 1, 25, and 36, claims 18, 34, and 39 include further patentable subject matter not found in Bunyan or Hill. In particular, claims 18, 34, and 39 recite that the non-ionic surfactant is derived from glycerin.

In the Final Office Action, the PTO appears to rely on Hill's disclosure of carboxylic acid esters for the claimed non-ionic surfactant derived from glycerin. Such a broad category of carboxylic acid esters also provides a plethora of possible variations without indication as to which variation is likely to succeed, at best, making it obvious to try any one of a number of carboxylic acid esters. More particularly, Hill nowhere discloses a non-ionic surfactant derived from glycerin.

In this respect, Appellants have discovered that the combination of non-ionic surfactants derived from glycerin with the claimed composition provides unexpected technical advantages to thermal interface materials, such technical advantages being indicative of non-obviousness. In particular, the combination provides improved peel strength as can be noted by comparison of examples 1 and 4 of the present specification. As is illustrated, use of a non-ionic surfactant derived from glycerin as at least part of the non-ionic surfactant provides an increase in peel strength of approximately 4 g/in.

For at least the foregoing reasons, Appellants respectfully submit that claims 18, 34, and 39 recite patentable subject matter in addition to the patentable subject matter of claims 1, 25, and 36, respectively. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

6. Claims 19 and 35 are patentable over Bunyan in view of Hill.

In addition to the reasons stated above with respect to claims 1, 25, and 36, claims 19 and 35 include further patentable subject matter not found in Bunyan or Hill. In particular, claims 19 and 35 recite that the thermal interface material comprises greater than about 10% by weight of the surfactant.

As stated above, Hill clearly teaches away from using greater than 4.5% non-ionic surfactant, stating that "the addition of any surfactant becomes a detriment above a concentration of about 4.5% of the BN filler weight." See Hill, pg. 3, ll. 19-20. As such, Hill clearly teaches away from the proposed combination, and in particular, teaches away from a combination in which the surfactant is used in amounts greater than about 10%.

For at least the foregoing reasons, Appellants respectfully submit that claims 19 and 35 recite patentable subject matter in addition to the patentable subject matter of claims 1 and 25, respectively. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

7. Claim 20 is patentable over Bunyan in view Hill.

In addition to the reasons stated above with respect to claim 1, claim 20 includes further patentable subject matter not found in Bunyan or Hill. In particular, claim 20 recites that the thermal interface material comprises between 14% and 25% by weight of the surfactant.

As stated above, Hill clearly teaches away from using greater than 4.5% non-ionic surfactant, stating that "the addition of any surfactant becomes a detriment above a concentration of about 4.5% of the BN filler weight." See Hill, pg. 3, ll. 19-20. As such, Hill clearly teaches away from the proposed combination, and in particular, teaches away from a combination in which the surfactant is used in amounts between about 14% and 25% by weight of the surfactant.

For at least the foregoing reasons, Appellants respectfully submit that claim 20 recites patentable subject matter in addition to the patentable subject matter of claim 1. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

8. Claim 51 is patentable over Bunyan in view of Hill.

In addition to the reasons stated above, claim 51 includes further patentable subject matter not found in Bunyan or Hill. In particular, claim 51 recites that the thermal impedance of the thermal interface material is ≤ 0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

In addition to Bunyan's and Hill's failure to teach use of non-ionic surfactant in amounts of greater than 7% by weight, Bunyan and Hill fail to teach or suggest the claimed improvement in thermal impedance. In an attempt to address such failures, the Examiner appears to take the position that the claimed thermal impedance is inherent to a composition including surfactant, asserting that the surfactant insures homogeneous dispersion of the conductive particles.

However, to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson* 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). The claimed thermal impedance does not necessarily result from the proposed combination. Therefore, the claimed thermal impedance is not inherent to the proposed combination.

For at least the foregoing reasons, Appellants respectfully submit that claim 51 recites patentable subject matter in addition to the patentable subject matter discussed above in relation to claims 1, 25, 36, and 42. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

9. Claim 52 is patentable over Bunyan in view of Hill.

In addition to the reasons stated above, claim 52 includes further patentable subject matter not found in Bunyan or Hill. In particular, claim 52 recites that the thermal interface material has a wetting angle of not more than about 80 degrees and a thermal impedance of no more than about 0.115 °C in^2/W, at an operating temperature. Claim 52 further recites that the thermal impedance of the thermal interface material is ≤0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

In addition to Bunyan's and Hill's failure to teach use of non-ionic surfactant in amounts of greater than 7% by weight, Bunyan and Hill fail to teach or suggest the claimed wetting angle or improvement in thermal impedance. In an attempt to address such failures, the Examiner appears to take the position that it would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the amount of surfactant added to the thermal interface composition in order to optimize the composition's wetting angle. The PTO further asserts that the claimed thermal impedance is inherent to compositions with the claimed wetting angle.

However, to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson* 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). The claimed thermal impedance does not necessarily result from the proposed combination having the claimed wetting angle. Therefore, the claimed thermal impedance is not inherent to the proposed combination.

Further, no evidence is provided that one skilled in the art at the time of the invention would have been motivated to seek a desired wetting angle in the thermal interface material. In fact, Appellants discovered that thermal interface materials exhibiting the claimed wetting angle provide desirable technical advantages, such technical advantages being indicative of non-obviousness. By way of example only, example 6 of the present specification illustrates previously unrecognized advantages, such as a reduction in a differential temperature, resulting from a thermal interface material having a wetting angle of less than 80 degrees.

For at least the foregoing reasons, Appellants respectfully submit that claim 52 recites patentable subject matter in addition to the patentable subject matter discussed above in relation to claims 1, 25, 36, and 42. Accordingly, reversal of this ground of rejection by the Board is respectfully requested.

10. Claim 53 is patentable over Bunyan in view of Hill.

Claim 53 is directed to a thermal interface material comprising a phase change wax and greater than about 7% by weight of a surfactant. As stated above, Hill clearly teaches against using greater than 4.5% non-ionic surfactant, stating that "the addition of any surfactant becomes a detriment above a concentration of about 4.5% of the BN filler weight." See Hill, pg. 3, ll. 19-20. As such, Hill clearly teaches away from the proposed combination, and in particular, teaches away from a combination in which the surfactant is used in amounts greater than about 7%.

In this respect, Appellants have discovered that the combination of nonionic surfactant (greater than 7% by weight) and a phase change component in the context of thermal interface materials provides notable technical advantages as already discussed above.

For at least the foregoing reasons, Appellants respectfully submit that claim 53 recites patentable subject matter. Accordingly, reversal of this ground of rejection by the Board is respectfully requested

VIII. CONCLUSION

For at least the foregoing reasons, Appellants respectfully request the board to review and reverse the two grounds for rejection subject to appeal.

Respectfully submitted,

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IX. APPENDIX 1: CLAIMS INVOLVED IN THE APPEAL (37 C.F.R. § 41.37(c)(1)(viii))

The text of each claim involved in the appeal is as follows:

1. A thermal interface material comprising:

a polymer component;
a phase change component mixed with the polymer component; and
greater than about 7% by weight of a non-ionic surfactant mixed with the polymer component and the phase change component.

2. The thermal interface material of claim 1, wherein the phase change component comprises a phase change wax.

3. The thermal interface material of claim 2, wherein the phase change wax comprises hydroxylated wax.

4. The thermal interface material of claim 2, wherein the phase change wax comprises between about 5% and 50% by weight of the thermal interface material.

5. The thermal interface material of claim 2, wherein the phase change wax comprises between about 10% and 35% by weight of the thermal interface material.

6. The thermal interface material of claim 1, wherein the phase change component is adapted to soften within a temperature range of 30°C to 120°C.

7. The thermal interface material of claim 1, wherein the polymer component comprises acrylic.

8. The thermal interface material of claim 1, wherein the polymer component comprises between about 5% and 25% by weight of the thermal interface material.

9. The thermal interface material of claim 1, wherein the polymer component comprises between about 9% and 23% by weight of the thermal interface material.

10. The thermal interface material of claim 1, further comprises a particulate thermally conductive filler.

11. The thermal interface material of claim 10, wherein the thermally conductive filler comprises boron nitride.

12. The thermal interface material of claim 10, wherein the thermally conductive filler comprises between about 10% and 50% by weight of the thermal interface material.

13. The thermal interface material of claim 10, wherein the thermally conductive filler comprises between about 20% and 35% by weight of the thermal interface material.

16. The thermal interface material of claim 1, wherein the non-ionic surfactant is derived from alkanolamide.

17. The thermal interface material of claim 1, wherein the non-ionic surfactant is derived from cocamide.

18. The thermal interface material of claim 1, wherein the non-ionic surfactant is derived from glycerin.

19. The thermal interface material of claim 1, wherein the thermal interface material comprises greater than about 10% by weight of the surfactant.

20. The thermal interface material of claim 1, wherein the thermal interface material comprises between about 14% and 25% by weight of the surfactant.

21. The thermal interface material of claim 1, wherein the polymer is an adhesive.

22. The thermal interface material of claim 21, wherein the adhesive is a pressure sensitive adhesive.

23. The thermal interface material of claim 21, wherein the adhesive comprises acrylate.

24. The thermal interface material of claim 21, wherein the adhesive comprises silicone.

25. A thermal interface material comprising a phase change wax and greater than about 7% by weight of a non-ionic surfactant.

26. The thermal interface material of claim 25, wherein the phase change wax comprises between about 5% and 50% by weight of the thermal interface material.

27. The thermal interface material of claim 25, further comprising a polymer component.

28. The thermal interface material of claim 27, wherein the polymer is an adhesive.

29. The thermal interface material of claim 27, wherein the polymer component comprises between about 5% and 25% by weight of the thermal interface material.

30. The thermal interface material of claim 25, further comprising a particulate thermally conductive filler.

31. The thermal interface material of claim 30, wherein the thermally conductive filler comprises between about 10% and 50% by weight of the thermal interface material.

33. The thermal interface material of claim 25, wherein the non-ionic surfactant is derived from alkanolamide.

34. The thermal interface material of claim 25, wherein the non-ionic surfactant is derived from glycerin.

35. The thermal interface material of claim 25, wherein the thermal interface material comprises greater than about 10% by weight of the surfactant.

36. A thermal interface tape comprising:

a first layer comprising a conductive film; and
a second layer comprising a thermal interface material comprising a phase change component and greater than about 7% by weight of a non-ionic surfactant.

38. The tape of claim 36, wherein the surfactant is derived from alkanolamide.

39. The tape of claim 36, wherein the surfactant is derived from glycerin.

40. The tape of claim 36, wherein the thermal interface material comprises a thermally conductive filler.

41. The tape of claim 36, wherein the second layer is coupled to a protective barrier.

42. A microelectronic structure comprising:

an integrated circuit active device;
a heat sink; and
a thermal interface tape comprising greater than about 7% by weight of a non-ionic surfactant and comprising a phase change component, the thermal interface tape disposed between and coupling the integrated circuit active device and the heat sink to each other.

51. A thermal interface material comprising a phase change component, greater than about 7% by weight of a non-ionic surfactant, and a thermally conductive filler, wherein the thermal impedance of the thermal interface material is ≤ 0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

52. A thermal interface tape comprising:

a first layer comprising a conductive film; and
a second layer comprising a thermal interface material coupled to the first layer, the second layer comprising greater than about 7% by weight of a non-ionic surfactant, a phase change component, a polymer, and thermally conductive filler, the thermal interface material having a wetting angle of not more than about 80

degrees and a thermal impedance of no more than about 0.115 °C in^2/W, at an operating temperature, wherein the thermal impedance of the thermal interface material is ≤ 0.8 x wherein x is the thermal impedance of a comparative thermal interface material having the same composition of the thermal interface material, but containing no surfactant.

53. A thermal interface material comprising a phase change wax and greater than about 7% by weight of a surfactant.

X. EVIDENCE APPENDIX (37 C.F.R. § 41.37(c)(1)(ix))

No evidence was submitted by Appellants pursuant to 37 C.F.R. §§ 1.130, 1.131, or 1.132.

XI. RELATED PROCEEDINGS APPENDIX (37 C.F.R. § 41.37(c)(1)(x))

Appellants, Appellants' legal representatives, and Assignee are aware of no decisions that have been rendered by a court or the Board.